14.7 The pH in solutions of strong acids and strong bases

* Strong Acids: acids that are almost completely dissociated in water to give H+.

Examples:

HClO4, H2SO4, HNO3

Monoprotic Acids: an acid that has a single dissociable proton.

HCL4, HCL, HNO3

Diprotic acids: an acid that has two dissociable protons.

H2SO4

Strong monoprotic acids dissociate completely, so the products H3O+ and Aˉ have the same concentration as the acid in the reactants HA.

HA(aq) + H2O(l) ---- H3O+(aq) + Aˉ

* Strong Bases: bases that dissociate or react completely with water to give OH-.

Examples:

Alkali metal hydroxides (group IA and OH): NaOH, KOH etc.

Alkali metals hydroxides are water-soluble, so they dissociate completely and their products M+ and OHˉ have the same concentration as the strong Base MOH in the reactants.

MOH(aq) ---- M+(aq) + OHˉ(aq)

Alkaline earth metal hydroxides (group IIA and OH): Mg(OH)2, Ca(OH)2 etc.

Alkaline earth metal hydroxides are strong acids, but because they are less soluble, they give less OHˉ concentrations.

Alkaline earth oxides (group 2A and O): CaO, MgO etc.

Alkaline earth oxides are stronger than the hydroxides, because O2ˉ is stronger base than OHˉ.

O2ˉ(aq) + H20(l) ---- OHˉ(aq) + OHˉ(aq)

Problem 14.10

Calculate the pH of the following solutions:

1. 0.050 M HCLO4
2. 6.0 M HCL
3. 4.0 M KOH
4. 0.010 M Ba(OH)2
5. HCL3 is a strong acid, so the concentration of HCL3 equals the concentration of H30+.

[HCL3] = [H3O+] = 0.050 M

Now we find the pH:

pH= -log [H3O+] = -log (0.050) = 1.30

1. HCL is strong acid so

[HCL] = [H30+] = 6.0 M

pH= -log [H3O+] = -log (6.0) = -0.78

1. KOH is a strong base, so the concentration of KOH equals the concentration of OHˉ.

[KOH] = [OHˉ] = 4.0 M

We need to find [H30ˉ] before calculate pH; we will use the Kw equation.

[H3Oˉ] = [Kw] / [OHˉ]

[H3Oˉ] = (1.0 x 10^-14)/(4.0) = 2.5 x 10^-15 M

pH= -log [H3O+] = -log (2.5 x 10^-15) = 14.60

1. is a strong base, so

[Ba(OH)2] = [OHˉ]= 2(0.010)= 0.020 M

[H3Oˉ] = [Kw] / [OHˉ]

[H3Oˉ] = (1.0 x 10^-14)/(0.020)= 5.0x10^-15 M

pH= -log [H3O+] = -log (5.0x10^-15) = 12.30

Homework for you my friends.

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Hints:

1. Is BaO a strong base?
2. Calculate the molarity of BaO.
3. Equal BaO concentration to OHˉ?
4. Calculate H3O+ by using Kw equation.
5. Finally calculate pH.

Your answer should be 11.81